

CLAIMS

I claim:

1. A seal for sealing a shaft, the seal comprising:

a sleeve constructed to be disposed generally coaxially around the shaft and comprising a parallel sleeve portion that is generally parallel to the longitudinal axis of the shaft and a radially extending sleeve portion that extends generally radially away from the longitudinal axis of the shaft;

an outer housing configured to generally surround the sleeve and comprising a parallel housing portion that is generally parallel to the longitudinal axis of the shaft, a radially extending housing portion that extends generally radially towards the longitudinal axis of the shaft, and a faceplate portion that extends generally radially towards the longitudinal axis of the shaft;

a first elastomeric protrusion extending generally between the radially extending sleeve portion and the faceplate portion and including a base and an end generally opposite the base and oriented generally radially towards the longitudinal axis of the shaft; and

a second elastomeric protrusion including a base secured to the housing and an end generally opposite the base and displaceable against the sleeve, wherein the end is oriented generally radially away from the longitudinal axis of the shaft.

2. The seal of claim 1, wherein the base of the second elastomeric protrusion is secured to the radially extending housing portion.

3. The seal of claim 2, wherein the end of the second elastomeric protrusion is displaceable against the radially extending sleeve portion.

4. The seal of claim 1, wherein the end of the second elastomeric protrusion is oriented generally both radially away from the longitudinal axis of the shaft and axially outward.

5. The seal of claim 1, further comprising a third elastomeric protrusion including a base secured to the housing and an end generally opposite the base and displaceable against the sleeve.

6. The seal of claim 5, wherein the end of the third elastomeric protrusion is displaceable against the parallel sleeve portion.

7. The seal of claim 5, wherein the base of the third elastomeric protrusion is secured to the radially extending housing portion.

8. The seal of claim 5, wherein the end of the third elastomeric protrusion is oriented generally axially outward.

9. The seal of claim 5, wherein the end of the third elastomeric protrusion is oriented generally axially inward.

10. The seal of claim 5, further comprising a fourth elastomeric protrusion including a base secured to the housing and an end generally opposite the base and displaceable against the sleeve.

11. The seal of claim 10, wherein the end of the fourth elastomeric protrusion is displaceable against the parallel sleeve portion.

12. The seal of claim 10, wherein the base of the fourth elastomeric protrusion is secured to the radially extending housing portion.

13. The seal of claim 10, wherein the end of the fourth elastomeric protrusion is oriented generally axially outward.

14. The seal of claim 10, wherein the end of the fourth elastomeric protrusion is oriented generally axially inward.

15. The seal of claim 10, further comprising a fifth elastomeric protrusion including a base secured to the housing and an end generally opposite the base and displaceable against the sleeve.

16. The seal of claim 15, wherein the end of the fifth elastomeric protrusion is displaceable against the parallel sleeve portion.

17. The seal of claim 15, wherein the base of the fifth elastomeric protrusion is secured to the radially extending housing portion.

18. The seal of claim 15, wherein the end of the fifth elastomeric protrusion is oriented generally axially inward.

19. The seal of claim 15, further comprising a garter spring associated with the fifth elastomeric protrusion.

20. The seal of claim 1, further comprising a third elastomeric protrusion including a base secured to the radially extending sleeve portion and an end generally opposite the base and displaceable against the housing, wherein the end is oriented both generally radially away from the longitudinal axis of the shaft and axially outward.

21. The seal of claim 20, wherein the end of the third elastomeric protrusion is displaceable against the parallel housing portion.

22. The seal of claim 1, wherein the end of the first elastomeric protrusion has a generally acute point.

23. The seal of claim 22, wherein the first elastomeric protrusion has an acute undercut angle.

24. The seal of claim 1, wherein the base of the first elastomeric protrusion is secured to the radially extending sleeve portion, the end of the first elastomeric protrusion is displaceable

against the faceplate portion, and the end of the first elastomeric protrusion is oriented both generally axially outward and radially towards the longitudinal axis of the shaft.

25. The seal of claim 1, wherein the first elastomeric protrusion is configured and oriented to guide inward traveling debris from the end of the first elastomeric protrusion towards the base of the first elastomeric protrusion.

26. A seal for sealing a shaft, the seal comprising:

a sleeve constructed to be disposed generally coaxially around the shaft and comprising a parallel sleeve portion that is generally parallel to the longitudinal axis of the shaft and a radially extending sleeve portion that extends generally radially away from the longitudinal axis of the shaft;

an outer housing configured to generally surround the sleeve and comprising a parallel housing portion that is generally parallel to the longitudinal axis of the shaft, a radially extending housing portion that extends generally radially towards the longitudinal axis of the shaft, and a faceplate portion that extends generally radially towards the longitudinal axis of the shaft;

a first elastomeric protrusion extending generally between the radially extending sleeve portion and the faceplate portion and including a base and an end generally opposite the base and oriented generally radially towards the longitudinal axis of the shaft; and

a second elastomeric protrusion extending generally between the housing and the radially extending sleeve portion and including a base and an end generally opposite the base and oriented generally radially away from the longitudinal axis of the shaft; and

a third elastomeric protrusion including a base secured to the radially extending sleeve portion and an end displaceable against the housing, wherein the end is oriented both generally radially away from the longitudinal axis of the shaft and axially outward.

27. The seal of claim 26, wherein the end of the first elastomeric protrusion has a generally acute point.

28. The seal of claim 27, wherein the first elastomeric protrusion has an acute undercut angle.

29. The seal of claim 26, wherein the base of the first elastomeric protrusion is secured to the first flange, the end of the first elastomeric protrusion is displaceable against the faceplate portion, and the end of the first elastomeric protrusion is oriented both generally axially outward and radially towards the longitudinal axis of the shaft.

30. The seal of claim 26, wherein the first elastomeric protrusion is configured and oriented to guide inward traveling debris from the end of the first elastomeric protrusion towards the base of the elastomeric protrusion.

31. The seal of claim 26, wherein the base of the second elastomeric protrusion is secured to the housing, the end of the second elastomeric lip is displaceable against the sleeve, and the end of the second elastomeric lip is oriented both generally axially outward and radially away from the longitudinal axis of the shaft.

32. The seal of claim 31, wherein the base of the second elastomeric protrusion is secured to the radially extending housing portion.

33. The seal of claim 31, wherein the end of the second elastomeric protrusion is displaceable against the radially extending sleeve portion.

34. The seal of claim 26, wherein the end of the third elastomeric protrusion is displaceable against the case body.

35. The seal of claim 26, wherein the end of the third elastomeric protrusion is displaceable against a part of the housing that is generally parallel to the longitudinal axis of the shaft.

36. The seal of claim 26, wherein the faceplate portion comprises a parallel faceplate portion that is generally parallel to the longitudinal axis of the shaft, and a front cover portion that extends generally radially towards the longitudinal axis of the shaft from the parallel faceplate portion.

37. The seal of claim 36 wherein the faceplate portion further comprises a third portion that extends generally radially towards the longitudinal axis of the shaft from the parallel faceplate portion.

38. The seal of claim 36, further comprising a fourth elastomeric protrusion including a base secured to the housing and an end displaceable against the sleeve.

39. The seal of claim 38, wherein the base of the fourth elastomeric protrusion is secured to the radially extending housing portion.

40. The seal of claim 38, wherein the end of the fourth elastomeric protrusion is displaceable against the parallel sleeve portion.

41. The seal of claim 38, wherein the end of the fourth elastomeric protrusion is oriented generally axially outward.

42. The seal of claim 38, wherein the end of the fourth elastomeric protrusion is oriented generally axially inward.

43. The seal of claim 38, further comprising a fifth elastomeric protrusion including a base secured to the housing and an end displaceable against the sleeve.

44. The seal of claim 43, wherein the base of the fifth elastomeric protrusion is secured to the radially extending housing portion.

45. The seal of claim 43, wherein the end of the fifth elastomeric protrusion is displaceable against the parallel sleeve portion.

46. The seal of claim 43, wherein the end of the fifth elastomeric protrusion is oriented generally axially outward.

47. The seal of claim 43, wherein the end of the fifth elastomeric protrusion is oriented generally axially inward.

48. The seal of claim 43, further comprising a sixth elastomeric protrusion including a base secured to the housing and an end displaceable against the sleeve.

49. The seal of claim 48, wherein the base of the sixth elastomeric protrusion is secured to the radially extending housing portion.

50. The seal of claim 48, wherein the end of the sixth elastomeric protrusion is displaceable against the parallel sleeve portion.

51. The seal of claim 48, wherein the end of the sixth elastomeric protrusion is oriented generally axially inward.

52. The seal of claim 48, further comprising a garter spring associated with the sixth elastomeric protrusion.

53. The seal of claim 26, further comprising a fourth elastomeric protrusion including a base secured to the faceplate portion and an end oriented generally radially towards the longitudinal axis of the shaft.